SOLMAX

QUICK REFERENCE GUIDE

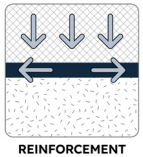
MIRAFI & MIRAGRID

The global leader in geosynthetics for civil infrastructure

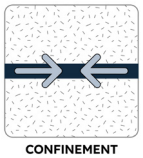
MIRAFI® geotextiles are high-performance, engineered solutions including woven and nonwoven geotextiles, paving interlayers, and specialty geotextiles used in civil engineering and environmental applications. **MIRAGRID**® geogrids are high-strength soil reinforcement solutions for mechanically stabilized earth (MSE) retaining walls, reinforced slopes, embankments and berms. These solutions enhance infrastructure performance and longevity while reducing project and installation costs.

SOLMAX GEOSYNTHETIC FUNCTIONS

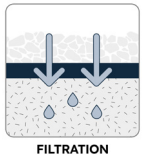
The placement of a flexible, porous geotextile between dissimilar material so that the integrity and intended functions of both materials remain intact or are improved.



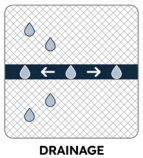
The synergistic improvement of a total system's strength in 360 degrees created by the introduction of a reinforcing geosynthetic (that is good in tension) into a soil and/or aggregate system (that is good in compression but poor in tension).



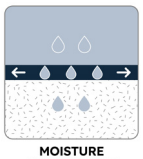
The ability of a geosynthetic to restrain lateral movement from a soil or aggregate through friction or mechanical interlock.



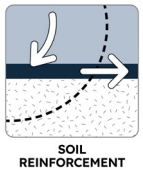
The equilibrium soil-to-geotextile system that allows for adequate movement of a liquid across the plane of the geotextile with limited soil loss over the service lifetime of the application.



The equilibrium soil-to-geotextile system that allows for adequate movement of a liquid across the plane of the geotextile over the service lifetime of the application.



The ability to move a liquid through soil geotextile system by capillary action, neither relying on gravity nor a positive hydraulic gradient.

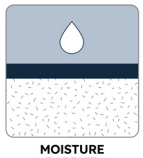


The addition of high strength reinforcement to soil backfill where primary loads and stresses are in 2-dimensions, like MSE structures and reinforced soil slopes.

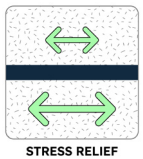
The use of an erosion control blanket (ECB) or turf reinforcement mat (TRM) to protect the soil surface and prevent soil particles from being detached by rainfall, flowing water, or wind.

The use of a geosynthetic to protect construction materials, including other geosynthetics, against damage.

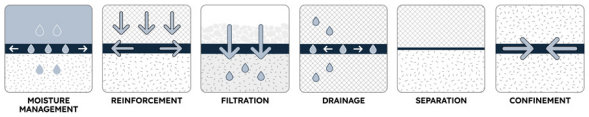
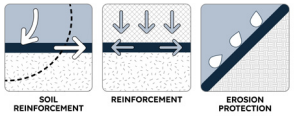
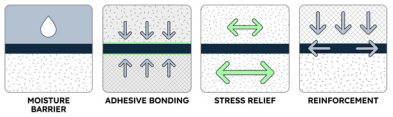
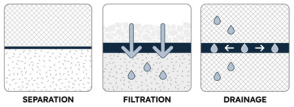
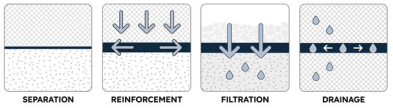
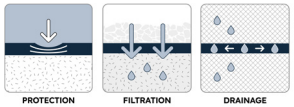
Adhering two different surfaces or materials using an adhesive substrate.



The use of a coating to create an impervious surface.



The stress reduction from a geosynthetic while the system is in a state of constant deformation or load.

APPLICATION	FUNCTIONS NEEDED	MIRAFI PRODUCT
Moisture management		**MIRAFI** H_2Ri
Roadway reinforcement (Stabilization base reinforcement)		**MIRAFI** RS*i*-Series
Engineered structure (Retaining walls/reinforced slopes/berms)		**MIRAGRID** XT Geogrids **MIRAGRID** Miramesh® GR
Pavement sustainability		**MIRAFI** MPG **MIRAFI** MPG^4 **MIRAFI** MPG^4-100
Drainage and filtration		**MIRAFI** FW-Series **MIRAFI** N-Series
Sludge pond/ash pond capping		**MIRAFI** S-Series
Environmental/solid waste		**MIRAFI** H_2Ri
GRS-IBS, embankments on soft ground, veneer reinforcement, Soft ground engineering	Contact your local Solmax Representative to identify the optimum **MIRAGRID** or **MIRAFI** product for your project.	

MIRAFI RS*i*-Series

Roadway reinforcement

The MIRAFI RS*i*-Series is engineered to integrate the five key performance properties of a woven geotextile in roadway performance: high modulus, separation, confinement, high water flow and product identification. They provide tensile strength at 5% strain up to 4,380 lb/ft (63.9 kN/m) (cross machine direction) per ASTM D4595.

FEATURES AND BENEFITS

- Higher modulus and water flow than traditional stabilization alternatives.
- Double layer construction provides varied pore sizes for excellent separation and superior filtration and flow characteristics of a fine to coarse sand layer.
- Provides excellent soil and base course confinement resulting in greater load distribution.
- Distinctive orange color allows for easy product identification.
- Panels can be seamed in the factory or field, providing cross-roll direction strength to facilitate efficient installation.

APPLICATIONS

- Paved & unpaved roadways
- Airport pavements
- Railway construction & ballast stabilization
- Parking lots
- Pipeline construction
- Drilling pads

Function	Test Method	Units	RS380*i*	RS580*i*
Strength				Patent #8,333,220 & Patent #8,598,054
Tensile Strength @ 2% Strain (CD)	ASTM D4595	lb/ft (kN/m)	1020 (14.9)	1800 (26.3)
Tensile Strength @ 5% Strain (CD)	ASTM D4595	lb/ft (kN/m)	2256 (32.9)	4380 (63.9)
Hydraulic				
Flow Rate[4]	ASTM D4491	gal/min/ft^2 (l/min/m^2)	75 (3056)	75 (3056)
Permittivity[4]	ASTM D4491	s^{-1}	0.9	1.0
Soil Retention				
Apparent Opening Size (AOS)[1]	ASTM D4751	U.S. Sieve (mm)	40 (0.425)	40 (0.425)
Pore Size O_{95}	ASTM D6767	Microns	392	394
Pore Size O_{85}	ASTM D6768	Microns	328	330
Pore Size O_{60}	ASTM D6769	Microns	245	248
Pore Size O_{50}	ASTM D6770	Microns	195	208
Soil Interaction				
Coefficient[2]	ASTM D5321	–	0.89[4]	0.9[4]
UV Resistance (at 500 hours)[4]	ASTM D4355	% Strength retained	90	90

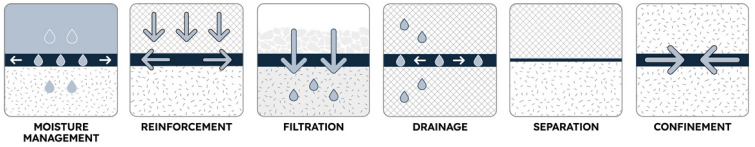
NOTES

All Mechanical Properties and Hydraulic Properties shown are Minimum Average Roll Values (MARV).
MD: Machine Direction, CD: Cross-Machine Direction

[1] ASTM D4751: AOS is a Maximum Opening Diameter Value
[2] Interaction Coefficient value is for sand or gravel based on testing conducted by SGI Testing Services.
[3] Typical Values
[4] Minimum Test Value

* Integration refers to the overall set of described characteristics based on a review of technical specifications for comparable products published by their respective manufacturers. Individual characteristics of these products vary and may meet, exceed, or fall below one or more of the above described individual characteristics.

MIRAFI H_2Ri



Roadway reinforcement with moisture management

MIRAFI H_2Ri provides enhanced lateral drainage of soil/aggregate materials through continuous moisture management in addition to providing the conventional functions of reinforcement, confinement, separation and filtration. Designed with high-tenacity polypropylene filaments and patented wicking filaments formed into an innovative weave, this woven geotextile provides superior reinforcement strength and soil interaction integrated with high soil retention and moisture management capabilities.

FEATURES AND BENEFITS

- Hygroscopic wicking yarns enhance drainage to remove water in saturated or unsaturated conditions.
- Features higher tensile strength properties than conventional geotextile products.
- Double layer construction provides excellent separation with superior filtration and drainage.
- Replaces drainage fill in high water table areas.
- Increases the performance life of the roadway in flexible pavements via mechanical and hydraulic stabilization.
- Mitigates frost heave and frost boils.
- Mitigates lateral edge cracking in expansive clays.
- Excellent soil and base course confinement resulting in greater load distribution.

APPLICATIONS

- Flexible pavements
- Unpaved roadways
- Airport pavements
- Parking lots
- Railway construction & ballast stabilization

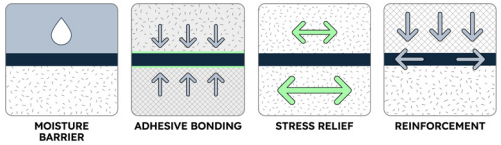
Properties	Test Method	Units	H_2Ri
Minimum Average Roll Value (MARV)			Patent #8,070,395 & Patent #7,874,767
Strength			
Wide Width Tensile (CD)	ASTM D4595	lb/ft (kN/m)	5280 (77.0)
Wide Width Tensile @ 2% Strain (CD)	ASTM D4595	lb/ft (kN/m)	1080 (15.8)
Minimum Roll Value			
Hydraulic			
Permittivity	ASTM D4491	sec^{-1}	0.4
Flow Rate	ASTM D4491	$gal/min/ft^2$ ($l/min/m^2$)	30 (1222)
Soil Retention			
Apparent Opening Size (AOS)[1]	ASTM D4751	U.S. Sieve (mm)	40 (0.425)
Typical Roll Value			
Pore Size O_{50}	ASTM D6767	Microns	85
Pore Size O_{95}	ASTM D6767	Microns	195
Minimum Test Value			
Wet Front Movement[1] (24 Minutes)	ASTM C1559[2]	Inches	6.0 (vertical direction)
Wet Front Movement[1] (983 Minutes)	ASTM C1559[2]	Inches	73.3 (horizontal direction)

NOTES

[1] 'STP': Standard Temperature and Pressure

[2] Modified

Petromat® MPG-Series



Pavement solutions

The **Petromat** MPG-Series are multi-axial composite paving grids designed to provide a moisture barrier in highly distressed pavement conditions. It is designed to require less asphalt tack, saving on installation costs without compromising performance.

FEATURES AND BENEFITS

- Provides quad-axial high tensile strength at low strain rates (< 3%).
- Offers cost-effective solution for full width overlay, local patch and joint repair.
- Prevents water from penetrating into the road sub structure.
- Retards crack propagation from the old surface to the new overlay.
- Provides uniform bonding between old and new asphalt layers to resist delamination.
- Easy to install on both milled surfaces, and on roads with curves.
- Chemically resistant to road salt, or other chemical deicing agents.

APPLICATIONS

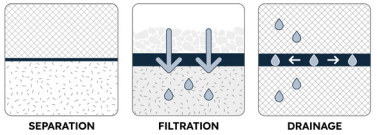
- Paved & unpaved roadways
- Airport pavements
- Parking lots
- Pipeline construction
- Drilling pads
- Railway construction & ballast stabilization

Properties	Test Method	Units	MPG⁴-100	MPG⁴	MPG100
Orientation			Quad-axial	Quad-axial	Biaxial
Minimum Average Roll Value					
Tensile Strength @ 0°	ASTM D6637	lb/in (kN/m)	570 (100)	345 (60)	571 (100)
Tensile Strength @ 90°	Method A	lb/in (kN/m)	570 (100)	345 (60)	571 (100)
Tensile Strength @ 45°	Modified	lb/in (kN/m)	570 (100)	345 (60)	N/A
Tensile Strength @ -45°		lb/in (kN/m)	570 (100)	345 (60)	N/A
Tensile Elongation		%	<3	<3	<5
Melting Point	ASTM D267	F° (C°)	Glass filaments are incombustible and temperature resistant up to 1472° (800°)		
Glass By Weight		%	90	85	
Mass/Unit Area	ASTM D5261	oz/yd² (g/m²)	23.3 (790)	16.6 (563)	20.0 (678)
Minimum Test Value					
Asphalt Retention	ASTM D6140	gal/yd² (l/m²)	0.23 (1.0)	0.17 (0.8)	0.27 (1.2)

NOTES

Tensile strength values refer to strength of the glass filaments.

MIRAFI N-Series



Drainage and filtration

MIRAFI N-Series nonwoven geotextiles provide excellent physical and hydraulic properties including high flow rates and small opening sizes. They can be used in a wide range of applications including soil separation, drainage and geomembrane liner protection within landfills.

FEATURES AND BENEFITS

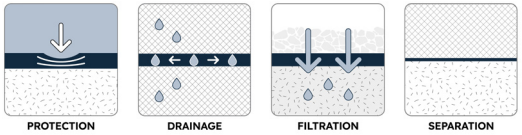
- Easily conforms to the ground or trench surface for trouble-free installation.
- Provides high puncture and tear resistance to withstand severe installation stresses.
- Provides high water flow rates and excellent filtration properties.
- Chemically stable in a wide range of aggressive environments.
- Offers a cost-effective alternative to graded-aggregate filters.

APPLICATIONS

- Flexible pavements
- Unpaved roadways
- Airport pavements
- Railway construction & ballast stabilization
- Parking lots

Properties	Test Method	Units	140NL	140NC	140N	160N	170N	180N	1100N	1120N	1160N
Minimum Average Roll Value (MARV)											
Strength											
Grab Tensile Strength	ASTM D4632	lb (N)	90 (401)	100 (445)	120 (534)	160 (712)	180 (801)	205 (912)	250 (1113)	300 (1335)	380 (1691)
Grab Tensile Elongation	ASTM D4632	%	50	50	50	50	50	50	50	50	50
Trapezoid Tear Strength	ASTM D4533	lb (N)	40 (178)	45 (200)	50 (223)	60 (267)	75 (334)	80 (356)	100 (445)	115 (512)	140 (623)
CBR Puncture Strength	ASTM D6241	lb (N)	250 (1113)	250 (1113)	310 (1380)	410 (1825)	450 (2003)	500 (2224)	700 (3115)	800 (3560)	1025 (4561)
Maximum Operating Size											
Apparent Opening Size	ASTM D4751	US Sieve (mm)	50 (0.30)	70 (0.212)	70 (0.212)	70 (0.212)	70 (0.212)	80 (0.18)	100 (0.15)	100 (0.15)	100 (0.15)
Minimum Roll Value											
Permittivity	ASTM D4491	sec^{-1}	2.0	2.0	1.7	1.5	1.4	1.4	0.8	0.8	0.7
Flow Rate	ASTM D4491	gal/min/ft² (l/min/m²)	145 (5907)	140 (5704)	135 (5500)	110 (4481)	105 (4278)	95 (3870)	75 (3056)	65 (2648)	50 (2037)
Minimum Test Value											
UV Resistance (at 500 hrs)	ASTM D4355	% Strength	70	70	70	70	70	70	70	70	70

MIRAFI S-Series



Protection with drainage and filtration

The **MIRAFI** S-Series provides excellent physical and hydraulic properties in addition to cushioning and protection, making them ideal for applications in the environmental market. These nonwoven geotextiles are manufactured to minimum weight and thickness properties.

FEATURES AND BENEFITS

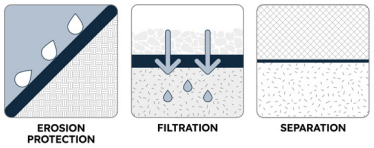
- Features flexible construction for trouble-free installation.
- Withstands severe installation stresses with high puncture and tear resistance.
- High permeability properties provide high water flow rates and excellent filtration properties.
- Chemically stable in a wide range of aggressive environments.
- Provides a cost-effective alternative to graded aggregate filters.

APPLICATIONS

- Landfill capping
- Pond capping
- Storage ponds & impoundments
- Landfill liner systems
- Brine & drilling mud pond liners
- Pipeline protection
- Railway construction & ballast stabilization

Properties	Test Method	Units	S600	S800	S1000	S1200	S1600	S2400	S3200
Minimum Average Roll Value (MARV)									
Grab Tensile Strength	ASTM D4632	lb (N)	170 (757)	230 (1024)	270 (1202)	320 (1424)	425 (1891)	500 (2225)	830 (3695)
Grab Tensile Elongation	ASTM D4632	%	50	50	50	50	50	50	50
Trapezoid Tear Strength	ASTM D4533	lb (N)	70 (312)	95 (423)	105 (467)	125 (556)	155 (690)	200 (890)	300 (1335)
CBR Puncture Strength	ASTM D6241	lb (N)	450 (2003)	600 (2670)	725 (3226)	900 (4005)	1200 (5340)	1800 (8010)	2200 (9790)
Weight	ASTM D5261	oz/yd² (g/m²)	6.0 (203)	8.0 (271)	10.0 (339)	12.0 (407)	16.0 (542)	24.0 (814)	32.0 (1085)
Thickness	ASTM D5199	Mils (mm)	80 (2.0)	90 (2.3)	110 (2.8)	120 (3.1)	175 (4.4)	200 (5.1)	290 (7.4)
Maximum Opening Size									
Apparent Opening Size	ASTM D4751	US Sieve (mm)	80 (0.18)	100 (0.15)	100 (0.15)	100 (0.15)	100 (0.15)	100 (0.15)	100 (0.15)
Minimum Roll Value									
Permittivity	ASTM D4491	Sec^{-1}	1.5	1.4	1.2	0.9	0.7	-	-
Flow Rate	ASTM D4491	gal/min/ft² (l/min/m²)	110 (4481)	110 (4481)	85 (3463)	65 (2648)	50 (2037)	-	-
Minimum Test Value									
UV Resistance (at 500 hrs)	ASTM D4355	% Strength	80	80	80	80	80	70	80

MIRAFI FW-Series



Drainage and filtration

MIRAFI FW-Series are highly UV stabilized, woven filtration geotextiles that are manufactured with unique monofilament yarns for use in water infrastructure and drainage projects. **MIRAFI** FW-Series feature unique physical and hydraulic properties not possible with standard woven or nonwoven geotextiles.

FEATURES AND BENEFITS

- Resists clogging while maintaining flow rate in high gradient and dynamic flow conditions.
- High survivability rating in aggressive installation and loading conditions.
- Resistant to chemicals commonly found in aggressive landfill environments.
- Uniform opening size (AOS) allows long-term clog resistance and high flow rates.

APPLICATIONS

- Stormwater drainage systems
- Coastline protection
- Leachate collection systems
- Landfill liner systems

Properties	Test Method	Units	FW300	FW402	FW403	FW404	FW500[1]	FW700
Minimum Average Roll Value (MARV)								
Strength								
Grab Tensile Strength (MD)	ASTM D4632	lb (N)	400 (1780)	365 (1624)	425 (1891)	400 (1780)	375 (1669)	370 (1647)
Grab Tensile Strength (CD)	ASTM D4632	lb (N)	335 (1491)	200 (890)	350 (1558)	320 (1424)	375 (1669)	250 (1113)
Grab Tensile Elongation (MD/CD)	ASTM D4632	%	20/15	24/10	21/21	15/15	15/7	15/15
Trapezoid Tear Strength (MD)	ASTM D4533	lb (N)	145 (645)	115 (512)	145 (645)	150 (668)	120 (534)	100 (445)
Trapezoid Tear Strength (CD)	ASTM D4533	lb (N)	125 (556)	75 (334)	125 (556)	165 (734)	120 (534)	60 (267)
CBR Puncture Strength	ASTM D6241	lb (N)	1250 (5563)	675 (3004)	1340 (5963)	1150 (5118)	1200 (5340)	950 (4228)
Maximum Operating Size								
Apparent Opening Size	ASTM D4751	US Sieve (mm)	30 (0.60)	40 (0.425)	40 (0.425)	40 (0.425)	50 (0.3)	70 (0.212)
Minimum Roll Value								
Permittivity	ASTM D4491	Sec^{-1}	1.5	2.1	0.96	0.90	0.2	0.28
Flow Rate	ASTM D4491	gal/min/ft² (l/min/m²)	115 (4685)	145 (5907)	70 (2852)	70 (2852)	15 (611)	18 (733)

NOTES

MD: Machine Direction, CD: Cross Direction [1]Cross direction yarns are slit film.

MIRAGRID XT Uniaxial Geogrid

Retaining walls and slopes

MIRAGRID XT are uniaxial geogrids featuring high strength, high tenacity, and high molecular weight. They are constructed of woven polyester with a polymer coating for applications where long-term design strength (LTDS) is necessary.

FEATURES AND BENEFITS

- NTPEP evaluated
- No recoiling
- Flexible and tough
- Lightweight
- Cost effective
- Standard & custom rolls
- High Long Term Design Strengths (LTDS)

APPLICATIONS

- MSE walls
- Steep reinforced slopes
- Reinforcement in landfill applications
- Embankments

Properties	Test Method	Units	2XT*	3XT	5XT	7XT	8XT	10XT	20XT	22XT	24XT
Wide Width Tensile Strength @ Ultimate (MD)	ASTM D6637	lb/ft (kN/m)	2300 (33.6)	3650 (53.3)	4700 (68.6)	6300 (91.9)	7600 (110.9)	10200 (148.8)	16000 (233.5)	21000 (306.4)	28000 (408.5)
Creep Reduced Strength (MD)	ASTM D5262	lb/ft (kN/m)	1597 (23.3)	2535 (35.5)	3264 (47.6)	4375 (63.8)	5278 (77.0)	7083 (103.3)	11111 (167.2)	14583 (212.8)	19444 (283.7)
Long Term Design Strength (MD)	GRI-GG4(b) (sand, silt, clay)	lb/ft (kN/m)	1383 (20.2)	2195 (32.0)	2826 (41.2)	3788 (55.3)	4570 (66.7)	6133 (89.5)	9620 (140.4)	12626 (184.2)	16835 (245.6)

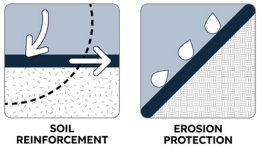
NOTES

All mechanical properties and hydraulic properties shown are Minimum Average Roll Values (MARV).

MD: Machine Direction, CD: Cross-Machine Direction

*__MIRAGRID__ 2XT is biaxial. All other __MIRAGRID__ XT geogrids are uniaxial.

MIRAGRID Miramesh



MIRAGRID Miramesh are biaxial geosynthetics designed to provide surface erosion protection and secondary reinforcement in MSE structures. **MIRAGRID** Miramesh GR is designed with a UV package for long-term applications and **MIRAGRID** Miramesh TR is ideal for temporary retaining wall structures.

FEATURES AND BENEFITS

- Vegetation support
- Strength
- Color
- Highly flexible
- UV stability
- Vegetated face

APPLICATIONS

- Slopes: vegetated & wrapped face
- Walls: permanent & temporary

Properties	Test Method	Units	GR*	TR
Tensile Strength @ Ultimate (MD/CD)	ASTM D4595	lb/ft (kN/m)	1440/1733 (21.0/25.3)	2100/2100 (30.6/30.6)
Creep Reduced Strength (MD)	ASTM D5262	lb/ft (kN/m)	471 (6.9)	686 (10.0)
Long Term Allowable Design Load (MD)	GRI-GT-7 (sand, silt, clay)	lb/ft (kN/m)	407 (5.9)	594 (8.7)
Aperture Size (MD)		in (mm)	0.08 (2)	0.08 (2)
Life Expectancy	See Note[2]	Years	75	25
Product Application Color			Long-term/Green	Temporary/Black

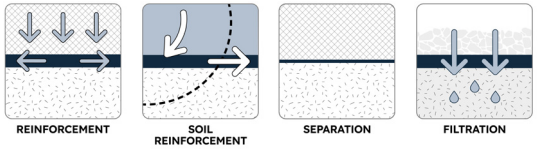
NOTES

Values shown are minimum average roll values.

* (Patent# 7,740,420)

[2] Extrapolated from the average half life based on ASTM D7238 (QUV). Data also found on **MIRAFI** UV Durability Tech Note.

MIRAFI CR-Series



Pond/sludge capping

MIRAFI CR-Series was designed for the pond capping market. These high-performance products feature engineered seams to efficiently install a stable capping system. **MIRAFI** CR-Series allows clay or geomembrane installation and construction of access roads over ponds without the need for most expensive, traditional methods.

FEATURES AND BENEFITS

- Engineered with industry leading seams to create a suitable capping system
- Strength facilitates the efficient closure of sludge impoundments and ponds.
- Allows water to pass through to relieve pore pressure.
- Contains fine-grained sludge material and separates sludge from clean fill above.

APPLICATIONS

- Pond capping
- Mining caps & closures
- Coal ash closure
- Tailings impoundment

Properties	Test Method	Units	CR220	CR330	CR440
Wide Width Tensile Strength					
Strength @ Ultimate (MD/CD)	ASTM D4595	lb/ft (kN/m)	4800/4800 (70/70)	7740/5820 (113/85)	7200/10620 (105/155)
Strength @ 5% Strain (MD/CD)	ASTM D4595	lb/ft (kN/m)	2400/3000 (35/43.8)	3960/5280 (58/77)	1500/5400 (21.9/78.8)
CBR Puncture	ASTM D6241	lb (N)	2000 (8900)	2500 (11125)	2700 (12015)
Flow Rate	ASTM D4491	gal/min/ft² (l/min/m²)	35 (1426)	65 (2648)	30 (1222)
Pore Size O_{95}	ASTM D6767	Microns	460	695	577
Pore Size O_{50}	ASTM D6767	Microns	275	330	265
Apparent Opening Size (AOS)	ASTM D4751	U.S. Sieve (mm)	30 (0.6)	20 (0.85)	30 (0.6)
Factory Sewn Seam	ASTM D4884	lb/ft (kN/m)	3000 (43.8)	3600 (52.5)	5652 (82.5)
UV Resistance (at 500 hours)	ASTM D4355	% Strength retained	80	80	85

NOTES

All mechanical properties and hydraulic properties shown are Minimum Average Roll Values (MARV).
MD: Machine Direction, CD: Cross-Machine Direction

About Solmax

Solmax is a world leader in sustainable construction solutions, for civil and environmental infrastructure. Its pioneering products separate, contain, filter, drain and reinforce essential applications in a more sustainable way – making the world a better place. The company was founded in 1981, and has grown through the acquisition of GSE, TenCate Geosynthetics and Propex. It is now the largest geosynthetics company in the world, empowered by more than 2,000 talented people. Solmax is headquartered in the province of Quebec, Canada, with subsidiaries and operations across the globe.

Uncompromised quality

Our products are manufactured to strict international quality standards. All our products are tested and verified at our dedicated and comprehensive laboratories which maintain numerous accreditations. We offer our partners a wide scope of testing according to published standards to ensure products delivered to sites meet specified quality requirements.

Let's build infrastructure better

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